Abstract

The present invention relates to a nanocrystalline metallic material, particularly to nano-twin copper material with ultrahigh strength and high electrical conductivity and its preparation method. High-purity polycrystalline Cu material with a microstructure of roughly equiaxed submicron-sized grains (300-1000 nm) has been produced by pulsed electrodeposition technique, by which high density of growth-in twins with nano-scale twin spacing were induced in the grains. Inside each grain, there are high densities of growth-in twin lamellae. The twin lamellae with the same orientations are inter-parallel, and the twin spacing ranges from several nanometers to 100 nm with a length of 100-500 nm. This Cu material invented has more excellent performance than existing ones. The tensile yield strength and ultimate strength of the present Cu material at room-temperature can be as high as 900 MPa and 1086 MPa, respectively, and such a high tensile strength can not be achieved for the Cu materials with the same chemical composition prepared by any traditional methods. Meanwhile, the present Cu sample also keeps a good electrical conductivity, for example, the room-temperature resistivity is $(1.75\pm0.02)\times10^{-8}$ $\Omega\cdot m$, corresponding to 96% IACS, which is close to that of the conventional coarse-grained Cu.